

V. CLAIMS

What is claimed is:

1. A method of providing reasonable assurance of a completed vend of a vendible item in a vending machine comprising:
 - 5 a. placing a set of optical emitters at spaced apart locations on one side of a dispensing area of the vending machine, the emitters each having on and off states, when in the on state emitting optical energy of predetermined characteristics;
 - b. placing a set of optical detectors at spaced apart locations on a generally
10 opposite side of the dispensing area, each detector having on and off states, the on state caused by sensing of at least a threshold level of optical energy of said predetermined characteristics;
 - c. holding all emitters in the off state for a time period, and if any detector turns on, generating an output signal;
 - 15 d. turning a first emitter of the set on for a time period, and if any detector does not turn on, generating an output signal;
 - e. repeating steps c. and d for each other emitter of the set;
 - f. communicating any output signal to a master controller of the vending machine.
2. The method of claim 1 wherein the emitters emit infrared energy.
- 20 3. The method of claim 2 wherein the emitters are LEDs.
4. The method of claim 3 wherein the LEDs output is modulated to a frequency range.
5. The method of claim 4 wherein the detectors are adapted to detect IR energy in the frequency range.
6. The method of claim 1 wherein there are five emitters.

7. The method of claim 6 wherein there are five detectors.
8. The method of claim 1 wherein the emitters are spaced approximately an inch apart.
9. The method of claim 8 wherein the detectors are spaced approximately an inch apart.
- 5 10. The method of claim 1 wherein the emitters are spaced apart from the detectors at least approximately ten inches and no more than approximately three feet.
11. The method of claim 1 wherein the output signal is indicative of a successful vend.
12. The method of claim 1 wherein the output signal is indicative of a successful vend or a detector malfunction.
- 10 13. The method of claim 1 wherein the output signal is used to control a vending regimen by the vending machine.
14. The method of claim 1 wherein the sequence the emitters of the set are turned on is other than in seriatim.
15. The method of claim 1 further comprising repeating steps c., d., and e. after each of
15 the emitters of the set has been turned on.
16. The method of claim 1 wherein an emitter is turned on for a different period of time than another emitter.
17. The method of claim 16 wherein the said emitter which is turned on a different period of time is an end-most emitter of the set of emitters.
- 20 18. The method of claim 1 wherein the output signal is retriggerable in steps c. or d.
19. The method of claim 1 wherein the time to cycle through steps c., d., and e. is designed to be less than estimated time for a vendible item to drop between the emitters and detectors in free fall.

20. An apparatus to provide reasonable assurance of completion of a vend of a vendible item from a vending machine, comprising:

- a. a first support member upon which is mounted a set of optical emitters in spaced apart locations;
- 5 b. a second support member upon which is mounted a set of optical detectors in spaced apart locations;
- c. a controller operatively connected to each emitter and detector, the controller programmed to:
 - i. control on and off of individual emitters for a period of time in a
 - 10 predetermined sequence, separated by a period of time all emitters are off;
 - ii. monitor a triggering threshold of each detector, the triggering threshold adapted to sense at least a certain level of optical energy of the type emitted by the emitters;
 - 15 iii. generates an output signal if any detector triggers:
 - 1. during any period all emitters are off; or
 - 2. during any period an emitter is on;
- d. an interface adapted for communication of the output signal to a master controller board of a vending machine.

20 21. The apparatus of claim 20 wherein the first and second support members comprise a circuit board.

22. The apparatus of claim 20 wherein the first and second support members have perimeter dimensions that do not exceed approximately several inches by one-half of foot.

23. The apparatus of claim 20 wherein there are five emitters.

24. The apparatus of claim 20 wherein there are five detectors.
25. The apparatus of claim 20 wherein the emitters are spaced from one another approximately one inch.
26. The apparatus of claim 25 wherein the detectors are spaced from one another approximately one inch.
27. The apparatus of claim 20 wherein the controller is a microprocessor.
28. The apparatus of claim 20 wherein the output signal is communicated to a interface to a master controller board of a vending machine.
29. The apparatus of claim 20 in combination with a vending machine.
- 10 30. A method of optically monitoring for a vend of a vendible product in a vending machine comprising:
- a. spacing out several emitters on one side of a vend area of the vending machine, the emitters adapted to emit electromagnetic energy of a restricted beam width and predetermined wavelength;
 - 15 b. spacing out several optical detectors on another side of the vend area, the optical detectors adapted to turn on when receiving electromagnetic energy of the predetermined wavelength over a threshold value;
 - c. upon a vend instruction to the vending machine monitoring for a vend by beginning a algorithm adapted to:
 - 20 i. turning on and then off the emitters in a predetermined sequence for predetermined time periods;
 - ii. checking if all detectors are on during the time periods any emitter is on;
 - d. if any detector does not turn on during the time period any emitter is on, generating a signal to the vending machine indicative that a vend has occurred.

31. The method of claim 30 wherein the signal comprises a pulse of an output line.
32. The method of claim 30 further comprising instigating a vend correction regimen if no signal is sent to the vending machine during an instructed vend cycle.
33. The method of claim 30 further comprising conducting a test of detector operation
5 before each emitter is turned on.
34. The method of claim 30 further comprising generating a signal if any detector is on during the time all emitters are off.
35. The method of claim 30 further comprising repeating step c for each emitter in a predetermined sequence.
- 10 36. The method of claim 36 further comprising generating the output signal for a time period.
37. The method of claim 37 wherein the time period for generating the output signal is longer than the time to turn on and off all emitters one time.
38. The method of claim 30 further comprising five emitters and five detectors, the
15 emitters spaced apart from each other in generally a row, the detectors spaced apart from each other in generally a row, and the emitters and detectors are spaced from each other across a dispensing area generally in alignment.
39. The method of claim 30 further comprising communicating the signal to the master controller board of a vending machine.
- 20 40. An apparatus for optically monitoring optically monitoring for a vend of a vendible product in a vending machine comprising:
- a. a set of several emitters spaced apart on one side of a vend area of the vending machine, the emitters adapted to emit electromagnetic energy of a restricted beam width and predetermined wavelength;

- b. a set of several optical detectors spaced apart on another side of the vend area, the optical detectors adapted to turn on when receiving electromagnetic energy of the predetermined wavelength over a threshold value;
 - c. a microprocessor operatively connected to each emitter and detector and having
5 a program which, upon a vend instruction to the vending machine monitoring for a vend by beginning a algorithm adapted to:
 - i. turning on and then off the emitters in a predetermined sequence for predetermined time periods;
 - ii. checking if all detectors are on during the time periods any emitter is on;
 - 10 iii. if any detector does not turn on during the time period any emitter is on, generating a signal to the vending machine indicative that a vend has occurred.
41. The apparatus of claim 40 further comprising a timer to time on and off of the emitters.
- 15 42. The apparatus of claim 40 further comprising a timer to time the length of time of the generated signal.
43. The apparatus of claim 40 further comprising a modulator to modulate the electromagnetic energy of the emitters.
44. The apparatus of claim 40 wherein the signal is adapted for communication to a
20 vending machine.
45. The apparatus of claim 40 wherein the signal is adapted for communication to a master controller board of a vending machine.
46. The apparatus of claim 40 wherein the signal turns a transistor on or off.
47. The apparatus of claim 40 wherein the signal operates a relay.

48. The apparatus of claim 40 in combination with a vending machine.

49. The apparatus of claim 18 wherein the vending machine is a snack vending machine with multiple rows and columns of dispensing mechanisms.

50. A system for optically monitoring optically monitoring for a vend of a vendible

5 product in a vending machine comprising:

- a. a dispensing area in the vending machine;
- b. a master controller controlling dispensation of vendible products in the vending machine;
- c. a set of several emitters spaced apart on one side of the vend area of the vending machine, the emitters adapted to emit electromagnetic energy of a restricted beam width and predetermined wavelength;
- d. a set of several optical detectors spaced apart on another side of the vend area, the optical detectors adapted to turn on when receiving electromagnetic energy of the predetermined wavelength over a threshold value;
- e. a microprocessor operatively connected to each emitter and detector and having a program which, upon a vend instruction to the vending machine monitoring for a vend by beginning a algorithm adapted to:
 - i. turning on and then off the emitters in a predetermined sequence for predetermined time periods;
 - ii. checking if all detectors are on during the time periods any emitter is on;
 - iii. if any detector does not turn on during the time period any emitter is on, generating a signal to the vending machine indicative that a vend has occurred.

51. The system of claim 40 wherein the algorithm further comprises an initialization of on and off times for the emitters.

52. The system of claim 40 wherein the algorithm further comprises an initialization of on time for the generated signal.